

SHOULD FAA TEST QUESTIONS AND ANSWERS BE PUBLISHED?

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This study examined the current practice of making pilot knowledge test questions and answers available to pilot applicants prior to taking the test. Our method for studying these effects was to present pilots with a second test designed to further assess their understanding of the material. On this second test, we systematically altered the test questions and answers in form, but not in informational content, in three different ways. Our aim was to observe any difference in pilots' scores as the questions they answered were altered from the ones they studied. It was hypothesized that if pilots truly understood the material, then these manipulations would not affect their scores. A significant drop-off in pilots' scores was observed for one of our manipulations: questions for which a different example was substituted in place of the one appearing in the FAA question. The implications of the findings are discussed.

Introduction

One of the prerequisites for obtaining a pilot certificate or rating is to pass an FAA pilot knowledge test. Popularly referred to as "written exams," these exams aim to test the pilot applicant's knowledge of technical subjects such as weather, aircraft systems and performance, and regulations. Pilot knowledge tests typically consist of 50 to 100 multiple-choice questions that are drawn from a larger database of questions that aim to exhaustively cover all of the important knowledge areas for each certificate or rating. In studying for these exams, pilot applicants have the option to review the FAA-published database of questions from which all the questions on the pilot knowledge tests are drawn. This has become a somewhat controversial issue because many wonder whether it allows pilots to focus their study on the questions and answers rather than on the underlying concepts and skills that the questions are designed to test. However, some argue that the pilot applicants generally know and understand the material, and that having the database of questions available allows pilots to more thoroughly review all knowledge areas. In this study, we presented a group of pilot applicants with a second, experimental test. Our exam contained the same questions as the FAA exam, but some of the questions were altered from their original form in different ways.

Our hypothesis was that if pilot applicants had a good

understanding of the material, then it was unlikely that our modifications would have a significant effect on pilot applicants' scores. However, if pilot applicants were employing a studying technique that involved the memorization of the FAA-published questions and answers without a true understanding of the material, then we might see a drop-off in performance as a result of our modifications.

Method

Participants

We recruited 17 pilot applicants who were scheduled to take the FAA private pilot knowledge test. Upon completion of the FAA test, participants were asked to complete our experimental test in exchange for compensation amounting to the cost of their FAA test. All participants took our exam within three days of taking the FAA exam. They were told that no extra studying was necessary to take our exam, and that the test was anonymous and their name would not be in any way associated with their answers.

Procedure

Our exams were created by manipulating the original FAA test questions in three different ways:

- (1) shuffling the answers to the questions,
- (2) rewording the questions and answers,
- (3) substituting a different example in the questions that had examples.

These three manipulations resulted in five different question types:

- (1) control questions without examples (unaltered from the FAA version),
- (2) shuffled questions,
- (3) reworded questions,
- (4) control questions with examples (unaltered from the FAA version),
- (5) different example questions.

The following are examples of each question type.

Control Questions Without Examples. This type of question was identical to the FAA questions that contained no example.

How should an aircraft preflight inspection be accomplished for the first flight of the day?

- A. Thorough and systematic means recommended by the manufacturer.
- B. Quick walk around with a check of gas and oil.
- C. Any sequence as determined by the pilot-in-command.

Shuffled Questions. This type of question shuffled the order of the answers in the original FAA questions.

How should an aircraft preflight inspection be accomplished for the first flight of the day?

- A. Quick walk around with a check of gas and oil.
- B. Any sequence as determined by the pilot-in-command.
- C. Thorough and systematic means recommended by the manufacturer.

Reworded Questions. This type of question reworded the question and answers in the original FAA questions.

For the first flight of the day, an aircraft should be preflighted using

- A. the procedure recommended by the manufacturer.
- B. a walk around with a check of gas and oil.
- C. a systematic procedure determined by the pilot-in-command.

Control Questions With Same Examples. This type of question was identical to the FAA questions that contained an example.

UA/OV KOKC-KTUL/TM 1800/FL120/TP
BE90//SK BKN018-TOP055/OVC072-
TOP089/CLR ABV/TA M7/WV 08021/TB LGT
055-072/IC LGT-MOD RIME 072-089

The wind and temperature at 12,000 feet MSL as reported by a pilot are

- A. 080° at 21 knots and -7 °C.
- B. 090° at 21 knots and -9 °C.
- C. 090° at 21 MPH and -9 °F.

Different Example Questions. This type of question substituted a different example in place of the example used in an FAA question.

UA/OV KMOD-KOAK/TM 2209/FL060/TP
PA28//SK OVC022-TOP050/
CLR ABV/TA M8/WV 28026/TB MOD 035-
060/IC LGT-MOD RIME 035-060

The wind and temperature at 6,000 feet MSL as reported by a pilot are

- A. 280° at 26 knots and -8 °C.
- B. 280° at 26 knots and 8 °C, measured.
- C. 220° at 9 MPH and -8 °F.

The experimental test that each participant took contained 10 questions of each type discussed above, resulting in a total of 50 questions. Random numbers were used to determine what type of manipulation each question would undergo, as well as the order in which the questions were presented to each participant. Upon completion of our experimental test, the scores for each question type were recorded.

Results and Discussion

Figure 1 shows the percentage of questions that were answered correctly for each question type.

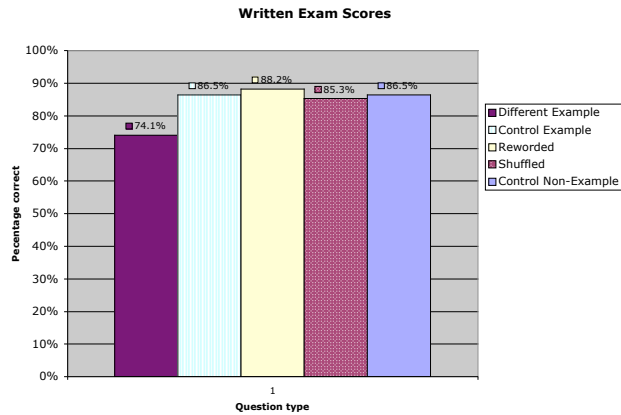


Figure 1.
Percentage correct for each question type.

We performed two analyses of variance to test for significant differences in pilot applicants' scores for the five question types. Figure 2 shows the results for the comparison of control, shuffled, and reworded question types. The shuffling and rewording manipulations resulted in no significant differences in pilots' scores ($F(2,32)$, $p=.62$). This result indicates that pilot applicants' understanding of the material (or memorization/studying technique) was sufficient to allow them to work through these manipulations.

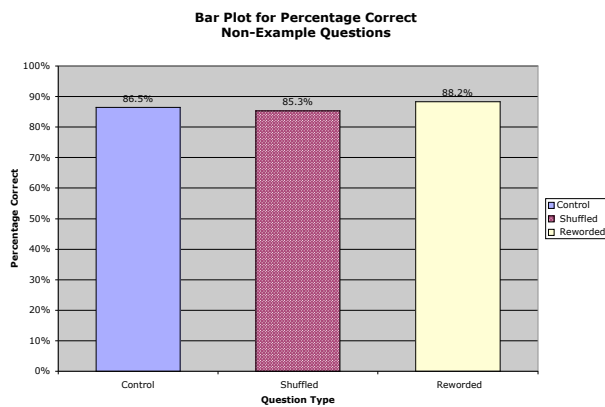


Figure 2.
ANOVA table and bar plot for the percentage of questions answered correctly on the experimental exam questions without examples. Results seen here were not significant.

Figure 3 shows the results for the comparison of control and different example questions. Pilot applicants' scores on questions that contained a different example were significantly lower than scores on the control questions ($F(1,16)$, $p=.01$).

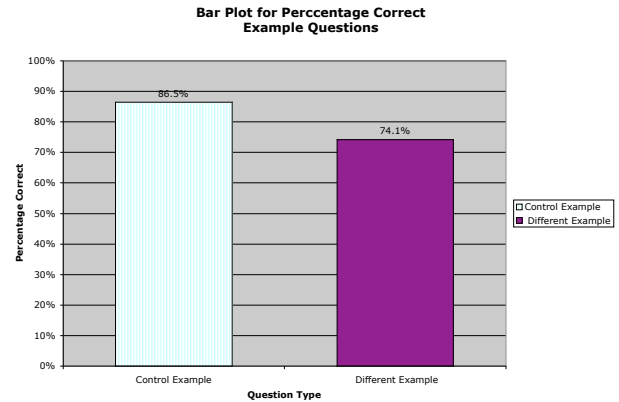


Figure 3.
ANOVA table and bar plot for the percentage of questions answered correctly on the experimental exam questions with examples. Results seen here were significant.

Recall that the different example questions required pilot applicants to use the same knowledge tested by the FAA questions, only with a different example. The significantly lower performance for these question types is disconcerting. The falloff in performance suggests that pilot applicants' learning is at least partly focused on memorizing the database of questions and answers.

It is most likely that pilot applicants use a combination of *understanding* and *memorizing* strategies. That is, they understand the material to some degree and then memorize questions and answers in order to expedite the test and maximize their scores. We must admit the possibility that the falloff in scores we observed might be due to some subjects' unwillingness to work through the unfamiliar example questions, accepting a lower score in the interest of time. Regardless, even for these "lazy" subjects, the falloff in scores between the two question types still suggests that question and answer memorization was used for the original FAA example questions, and their underlying knowledge of the material remains unknown.

Conclusion

Our hypothesis was that publishing the database of questions and answers from which pilot knowledge exams are drawn might be allowing pilot applicants to pass the exams without obtaining a true understanding of the aeronautical knowledge that the exams are meant to gauge. This preliminary study provides evidence that this hypothesis may be true. However, the biggest conclusion that can be drawn is

that it is difficult to determine what pilot applicants actually know, based on these exam results.

One easy solution could be to discontinue publication of the exam questions and answers. Indeed, the FAA has recently announced that they will withhold some questions and answers, and that they expect this move to result in an overall lowering of test scores.

As troublesome as these results may seem, it is important to note that the overall scores for each question type on our exam were above passing. At their worst performance, participants answered 74% of the different example questions correctly, which though marginal, does qualify as a passing score.

It is also important to note that pilot knowledge tests are not the *only* means used to assess pilot mastery of the required aeronautical knowledge. Every pilot applicant for an FAA certificate or rating must also pass a practical exam that includes an oral review of the applicant's mastery of this same material. Deficiencies in any knowledge area are grounds for failure of the practical test. However, because it is not possible to question an applicant on every aspect of every knowledge area during an oral exam, the possibility remains that some knowledge gaps may go undetected.

More research needs to be conducted before definitive conclusions can be drawn. Future studies might query subjects about their studying techniques as well as their problem-solving processes during the exam. Varying the difficulty of questions that contain different examples might help test the theory that subjects were unwilling to work through this type of question. Interviews with test-takers designed to probe their knowledge more deeply might help clarify the relationship between what pilot applicants actually know and their resulting test scores.